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Intensive milk production systems and their problems

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ABSTRACT - Milk production in Yugoslavia is ensured by 2.9 million cows, 97% in privately owned farms, generally in small herds of less than 5 cows, that do not have the means to update facilities. The big government farms are highly mechanized. Their evolution permits to study the main problems of intensive production, stabling, feeding system, disposal of excreta, and especially milking system. This last point is essential. Milking is the result of the animal-man-machine interaction. The milking machine and parlour have undergone many technological improvements, but man plays always the most important role for milking quality. This is even more so as the cows production and the importance of the herd increase.

Key words: Intensive production systems, stabling, feeding system, digestion, milking, cattle.

RESUME - «Systèmes intensifs de production laitière et leur problèmes». La production de lait en Yougoslavie est assurée par 2,9 millions de vaches, 97% étant généralement dans des élevages privés, généralement en petits troupeaux de moins de 5 vaches qui ne disposent pas de moyens pour moderniser leurs exploitations. Les grandes exploitations d'état sont très mécanisées. Leur évolution permet d'étudier les principaux problèmes posés par la production intensive, stabulation, système d'alimentation, évacuation des déjections et surtout système de traite. Ce dernier point est fondamental. La traite est le résultat de l'interaction entre l'animal, l'homme et la machine. La machine de traite et la salle de traite ont bénéficié de nombreuses améliorations technologiques, mais l'homme joue toujours un rôle prépondérant pour la qualité de la traite. Cela est d'autant plus vrai que la production de vaches et l'importance du troupeau augmentent.

Mots-clés: systèmes intensifs de production, stabulation, système d'alimentation, digestion, traite, bovins.

Yugoslavia has 23 mio inhabitants and is a country with great differences in many aspects. There are several, very different climates, from alpine with moderate summers and strong winters, continental with hot summers and very strong winters, to mediterranean with hot summers and mild winters. There are great topographical differences, differences in the soil quality, differences in the stage of development between different areas of the country, differences in mentality, working habits, etc.

Milk production in Yugoslavia

Country has 2.9 mio cows of different breeds and great differences in milk yields per cow, 97% of all cows are on private, predominantly small farms and some 3% are on large farms belonging to agroindustrial enterprises or cooperatives.

Private producers

Private producers have 1-80 cows (majority under 5). The trend on private farms is to increase the size of the herds and there is a trend towards modernization of cowsheds, machine milking, mechanized manure handling, etc. Farms

over 15 cows are very intensive due to limited land resources and are more or less specialized in milk production. The largest ones are entirely dependent on milk. Nevertheless, the majority of small farmers has insufficient capital and interest to modernize milk production which leads to difficulties mostly in milk hygiene. According to the law, since 1970 all milk delivered to the dairies has to be cooled below 10°C. This could be great improvement in milk quality, if the hygienic conditions would be improved as well. But leaving the hygienic conditions on the same level and applying cooling as the only measure for improvement of milk quality, leads predominantly only to change in microflora. Lactic acid producing microorganisms are restrained, but psychrotrophs are favored and expanding. Instead of milk souring, there are intensive lipolytic changes, bringing new problems. In this respect, much better situation is on intensive dairy farms.

Large farms

The conditions on large farms with hundreds and thousands of cows are quite different from those on the small ones and vary from one to another due to different housing systems, feeding, milking, manure handling and especially in the quality of the farm management. Large

herds have, without doubt, many advantages and are consequently increasing in size in almost all countries. The conditions are becoming more and more intensive, more cows are kept in the same cowshed, more cows are looked after per man and milked per man/hour, more milk is produced per cow and should be therefore produced more economically. In such intensive systems of milk production with industrial-type conditions there are in many ways improved conditions for man, cow and milk/new design of cowsheds, better environment, better hygiene, decent working conditions, etc., but at the same time there are problems, especially for management. With growing herd size a very serious one is certainly the danger of loss of control over cows and even over man employed on the farm. This is the key point where the problems of large herds start, regardless of all other management problems. What is the good of the highly sophisticated system where we have 100 cows per man and 80 cows milked per man/hour if the individual treatment of cows is lost, followed by stress situations, mastitis and final loss of milk. We must not forget the feature of animal behaviour, whereby the sociological factors in herds/especially large ones/interfere with production. In the search for increased economy through higher efficiency of man, there are limits beyond which more cows per man do not necessarily mean more milk per man and better economy. Management mistakes on small farms can cause harms which could be overcome, but the same mistakes on large farms can be disastrous and repairable only with great difficulties and losses or not at all.

Technological solutions

Technological solutions for large herds are by no means simple multiplications for the small ones. The solutions for 50, 100 or 150 cows are in many respects entirely different from those for 400 or 600 cows or more. Too many mistakes were and are still made when projecting of such farms is done without precise knowledge of all details which make correct technology based on research work and experience. Mistakes in projects of such units can disable any, even the best possible management, to run the farm efficiently.

Different climatic and topographic conditions, different social conditions, mentality etc. require individual, careful approach to each project of milk producing farm. Uncritical transplantations of ideas, technology and technique from one country to another, leads to expensive paid mistakes.

The more the farm is intensive and specialized in milk production, the more it is susceptible and dependent upon agro-economic policy of the government and on market situation. The dependence grows with the size of the farm, but there is practically no difference between a specialized farm with some 40 cows, or a farm with 400 cows, as under unfavourable agro-economic policy both are ruined. They are unable to switch quick enough or not at all to another kind of production. Loss of such farms means loss of milk and if that happens in areas where the milk is scarce it could be regarded as a tragedy.

Large farms with hired labour have to compete with industry for manpower. In future, the situation can only get worse. The tendency is now not only to make work easier through mechanization, but to replace the labour through automation of as many processes as possible. This is another danger, as higher technology requires more knowledge, higher education and experience on all levels. There are too many farms which started very high, with most sophisticated technology and high yielding cows, but in a couple of years ended very low, practically ruined. The reason: management level was inadequate to given technology.

Problems of intensive milk production systems

Through years we were projecting intensive, large dairy/and beef, sheep and goats/farms, analysing them critically afterwards from the point of view of chosen housing system, feeding, milking, manure handling, cow and man behaviour and management problems.

Housing system

First problem is to choose correct housing system for conditions in question.

Tied-up system, conventional for small herds was dubious for increased number of cows, especially where grazing was to be practised. Tying-up cows and grazing is contradictory as it is tying-up and milking in the milking parlour. To loosen the cows and bringing them back to their stands is tiring for milkers and causes confusion and stress in the barn. This is why in such cases pipe line milking system in the shed was applied and mechanized manure removal /where bedding was used/, or one of the systems of liquid manure handling in the cases without bedding. For certain reasons, in spite of the drawbacks, this system in zero grazing conditions is still practised.

Loose-housing is alternative, but this system has many, quite different solutions. For our conditions, the principal arrangement are cowsheds with cubicles, manure removal with delta scrapers /sometimes slatted floor/ and afterwards separation with decanters /horizontal separator/. Milking is done in any kind of milking parlour /herringbones of different sizes, unilactor, polygone/. Based on these principles, we have developed new solutions for farms of 200-300, 400-600 and 1,000-1,200 cows and more, taking into account all factors which could be influential.

Feeding system

Important problem to clear is the feeding system. In areas with grazing possibility, the herd size should not exceed 250-300 cows. The walking distances are becoming too long for both, cows and man/women, having side effects as well, which are influencing proper management of the herd. This size of a herd can be housed in one cowshed,

divided into 4 groups of 60-75 cows each. The number of cows in a group should not exceed that number, as already this is on the high side. The reasons are numerous, from difficulties in cow traffic, cow behaviour to efficient control and individual treatment of cows. Loosing individual control of cows, the control over herd is lost.

In zero grazing areas or where the herd exceeds 250-300 cows, the feed is brought to cows in the shed. Nowadays the concentrate feeding is moved out of the parlour to computerized feeding stalls mounted in feeding/resting area. The rule about the number of the cows in a group remains the same. The arrangement of the cowshed differs with the size of the herd, but the construction is in principle the same. Special attention is paid to undisturbed cow traffic to and from the milking parlour. The solution is original and well functioning on many farms.

Manure

In large herds manure became the greatest problem. It is influenced by many factors, from the size of the herd, kind of bedding, characteristics of the soil, underground water resources, surrounding of the farm to tourist season, etc. On one hand it is a valuable by-product, on the other it requires in some areas high investable by-product, on the other it requires in many areas high investment and running costs for its handling. Great problem can be its disposal as great quantities of manure are produced on a relatively small area. Separation process of liquid manure is expensive and still does not entirely solve the problem with the liquid phase. The problem with manure requires much more attention especially for areas with dense population.

Milking systems

Milk as the main product of the dairy farm requires special attention. Milking finalizes all previous efforts and all kind of inputs on a dairy farm and is of the same importance as feeding. Unfortunately, this is too often neglected with all undesirable consequences. It can already start with wrong choice of milking machine, not bearing in mind, that for a large herd even the best ones are only good enough. Milking should be regarded as the most important work on the dairy farm and should be given top priority. Based on our experience, we would like to throw more light on milking process, for better understanding and less mistakes on the management side.

Milking as an interaction between cow, man and machine was in this century influenced by many changes, especially in the last fifty years. This is based on intensive research work on animal as well as on the milking machine side.

In many countries the average milk production per cow is close to 5,000 l. and in some exceeding 6,000 l. and more. Yet there are even in Europe countries, where the average milk production per cow is less than 2,000 l. These figures

have to be taken into account, when any decision about milking and milking systems are taken. It certainly has to differ if there is a herd with a production of 2,000 l. of milk per cow or a herd with a production of 6,000 or 8,000 l. milk per cow.

Milking machines have reached high technical level, aiming at efficient milking, gentle udder and milk treatment, excluding human errors as much as possible. Milking machines have been developed to systems, with high efficiency of 200 and even more cows per hour and 80-90 cows per man/hour. The same applies to sheep milking; there are systems and breeds where they milk up to 600 sheep per hour and up to 300 sheep per man/hour. Milking systems are becoming more and more sophisticated, on one hand simpler in use, on the other hand more pretentious in maintenance and hopelessly complicated in case of breakdowns. Their proper function depends on the skill of the man using them and on the quality of the service. These two elements are decisive factors when proposal and decision about the milking system is taken. This principle is however often difficult to maintain, especially in developing countries. Often in these countries they do not understand this principle and if they are not offered the latest solution and most sophisticated equipment, they feel that they are underestimated.

Besides the cow and the milking machine the third interactional factor is the milking operator. His task is to follow an efficient milking routine and correctly handle the cows, the machines and the milk. Although we know the importance of his work, much less is known of his actual work and work load, especially in industrial milk production.

When mentioning the milking routine it is quite normal to look at the milkers work from the point of view of the cow, the machine or the milk. When for example, dealing with stimulation, who is thinking of the actual work and work load of the milker, instead of only considering how the work should be done from the point of the cows physiology and milk hygiene. The same thing happens in other phases of the milking routine. When the milking unit falls off, the first factors to be considered are the milk hygiene and stress to the cow. However, what happens to the milker? How many additional movements are required, how much stress is the milker in this and similar situations exposed to? These questions have only been considered by a few research workers. Priority in most such studies is given to industry and industrial workers and in agricultural sector to tractor drivers, but not to people engaged in animal production, especially not to milkers.

When dealing with the work load of a milker, two kind of milkers should be distinguished:

- a smaller milk producer/farmer, where he and/or any member of his family is milking their cows/,
- hired labour/professional milker, who is involved in the milking process of a large herd.

In both cases there could be hand or machine milking, but man is more and more replaced by machines, especially in larger herds. No wonder, if we know that for obtaining 1.

liter of milk up to 200 squeezes of teats/and fists/are needed.

With increasing yields per cow and growing herd sizes, even a small scale farmer has to consider machine milking, especially the older ones. Under present circumstances of high yielding cows, professional milker milks some 15 cows twice a day and takes all other care of them as well. This may be regarded as quite low efficiency, but hand milking is such a strainful work, that we know cases, where milkers being in the job for many years were 100% invalides, not being able to close their fists. The number of cows per hand milker varies from country to country and from farm to farm, from 7 to 25 cows.

Machine milking is certainly the solution and it is the general opinion that machine milking facilitates the work, makes it not only easier, but also quicker, more attractive, better for milk hygiene etc. This is certainly true in the case of small farmers, where the number of cows remains the same and machine milking brings practically all benefits which are mentioned above.

In the case of hired labour the situation is completely different. Milking machine is today of course the only reasonable solution, but first it has to bring higher efficiency i.e. more cows and liters of milk per man. Investment has to decrease the labour force and the remaining personnel has to milk 40-60, in extreme cases even more than 100 cows in tied-up system and 60-90 cows per hour in a milking parlour. There is certainly an important question if the milking machine in such cases facilitates the work and how the increased number of cows per man influences the work, physical strain and the behaviour of the milkers.

Difficult working conditions might be the answer to the fact, that the turnover rate of milkers is very high and that in spite of a high unemployment rate in many countries, it is still difficult to find milkers, especially good ones. But can this only be related to unsuitable working times, not attractive working place, inadequate payment as mentioned so many times?

There are only a few investigations concerning the work load of milkers in machine milking plants, one of the first studies were made by MICHAELI & MÜLLER (1942). Researches have been made on small numbers of milkers and/or small number of cows, or under simulated conditions, with the first exception of SEABROOKS study (1972). He did his research in herringbone parlours and in larger herds. The general conclusions of these studies is that machine milking reduces the work load, is not physically pretentious and can be estimated as lightly to moderately heavy work. Similar statements are mentioned in different reports, papers and lea Flets. There is obviously a discrepancy between these statements and the situation of milking operators in industrial milk production plants.

To get an answer of the actual work load of milkers in large herds, time and motions studies of milkers on different farms with different milking systems have been made.

Research was made at:

- 3 farms with tied-up system/pipe line milking in the barn-RTS, 300-400 cows on each farm/,
- 1 farm with loose housing system/Unilactor parlour, 17 units, 300 cows/,
- 2 farms with loose housing system/herringbone parlour, 2 x 10/20 units, 400 cows and 300 cows, respectively,
- 1 farm with loose housing system/polygone parlour, 4 x 5/20 units, 180 cows/.

Altogether there were 39 milkers observed and significant movements registered/number & time/including the steps taken.

The reason why the tied-up system farms were included in the research was because they are not only existing, but newly made as well, even in large scale. Management on such farms is easier than in loose housing system, since each man is responsible for a certain number of cows /usually 40-60/ and as they are tied-up, he is practically tied to them. From managements point of view this system is in certain conditions justified, but it is a question if it is justified from milkers point of view.

A statement has to be made about the milker as «man» and expressions such as «cows per man», «cows per man/hour» etc. In 90% of investigated cases the milkers were women and they are often more careful, more devoted to their work and better milkers than man.

The characteristic movements during milking in tied-up system barns were bends, squats and water bucket carrying, registered separately for each group of 5 cows (8 groups, 40 cows/milker).

During milking of 40 cows, milkers made in average 356.56 squats and bends, which means in average 713.12 per day. The milkers are bending rather than squatting, as they regard bending to be easier. This is however dangerous for their health as in average 228.4 bends per milking and 456.8 per day can affect their spine. Even worse, they are strictly bending when lifting water buckets and making sometimes very odd movements. They spent 58% of total milking time in squats and bends /87.13 min./ out of which the bends took 38.3 minutes or 76.6 per day.

Investigations have shown, that this system of milking is very straining for milkers. All of them complained about heavy pains in legs and backs after having milked. Those who made correct stimulation and machine stripping, had heavy pains in their fingers, underarms and shoulders. They have difficulties to fall asleep, in spite of being very tired, due to cramps in fingers and sore hands, legs and back. Especially were suffering the milkers on the farms, where the housing was not correct, resulting in dirty udders, tails and generally dirty animals. They have spent prolonged time in cleaning the udders, tails and flanks increasing the strain in fingers and hands and, of course, prolonging the milking time.

What is worth paying attention to is that all milkers without hesitation confirmed that hand milking was less

straining than machine milking. By hand they milked in average 16 cows, now they had to milk 40 of them. Obviously, the increase in number of cows per milker is not compensated by relief, which is what the milking machine is supposed to give.

The investigations in different milking parlours/herringbone, Unilactor, polygon/ have shown some mutual characteristics concerning the milkers, compared with investigations in tied-up system /pipe line/, but some of them quite different, less straining.

Mutual were the pains in fingers and hands, especially on those farms where the housing system was not correct, or the management was inadequate/not sufficient bedding etc/. All the failures in the system or management of a dairy farm will be reflected sooner or later in the milking parlour, increasing the work load on milkers, prolonging their working time and exposing them to stress situations.

There were less pains in backs and legs, which could be expected, although inadequate construction of the parlour, especially of the working pit has a painful effect on milkers hands, neck and shoulders. This is due to great distance between the milker and the udder, so he has to stretch his hands very far and at the same time hold his head back as he comes in the zone where a kick may be dangerous.

Generally speaking, there are too many stressing situations during milking. Malfunctioning milking machines, resulting in difficult attachment or falling-off clusters disturbing the routine, dangerously kicking, newly calved heifers /25-30% of the herd/ and/or unexpected disturbances of any kind electrical breakdowns, disturbed cow traffic, etc/.

During milking a milker makes some thousand steps/ up to 11,740 steps were registered/, the highest numbers were in tied-up barns followed by polygone and herringbone and the smallest numbers in unilactor parlour. The milkers walk kilometers long ways during their work on wet, often slippery floors in heavy boots which is an additional effort.

The investigated herds had numerous cows with bad morphological characteristics of their udder as well as hard milking cows. They are increasing the physical and

psychological load of the milkers and are one of the main stress factors, influencing in the same time efficiency of milk production.

A special problem is the working time in two shifts. Milkers have to get up for morning milking between 2.30 a.m.-3.30 a.m. and start their work at the lowest point of the physiological rhythm. The milkers were with few exceptions moderately tired when they come to the afternoon milking, which they start at the second low point of physiological rhythm. When they had finished both the morning and the afternoon milking they were very tired, some of them exhausted.

The present demands on efficiency in industrial milk production are already so high that milking machines and systems cannot compensate higher efforts of the milkers. Very hard straining work is in some countries compensated with high wages, in some countries with medals and in some with neither of them, which results in high job turnover.

Further investigations are needed for different housing and different milking systems in different climatic conditions, different mentality and social conditions, to find the optimal work load for milker. Exaggeration in demands for efficiency is dangerous for milkers, cows and installations and may result in negative economic results, the contrary to what was expected.

Dairy farm must form well coordinated system which includes several subsystems/feeding, milking, manure handling/and many activities. They are in interaction, and if care is not taken, collisions are inevitable. As a farm works 365 days per year, from early morning to late evening, any mistakes should be avoided already during projecting stage, as they will make already straining work unbearable.

Milk production is an aggressive business, which requires know-how to avoid how-now. A dairy farm is not ruined from one day to another. It gets ruined day by day and at the begin invisible but later rapidly deteriorating. Careful registration and corresponding action must be taken immediately, when any undesirable signs are observed. Good planning and good management are precondition for a successful milk production.